DOCUMENT RESUME

ED 076 600 TM 002 580

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TITLE	Prediction of Achievement with Measures of Learning, Social Behavior, Sex and Intelligence.
PUB DATE	73
NOTE	15p.; Paper presented at Annual Meeting of National Council on Measurement in Education (New Orleans, Louisiana, February 25 - March 1, 1973)
EDRS PRICE	MF-$0.65 HC-$3.29
DESCRIPTORS	*Academic Achievement; *Achievement Tests; Grade 3; *Predictive Ability (Testing); *Predictor Variables; Sex (Characteristics); Social Behavior; Standardized Tests; Technical Reports; Testing

ABSTRACT

The purpose of this research was to determine whether sex, teacher grades, standardized achievement test scores, intelligence test scores, and teacher ratings of children's classroom social behavior are long-range (eight years) predictors of academic achievement. Significant and high Rs were found for all criteria (teacher grades and standardized achievement test scores) ranging from .64 to .86. Sex, teacher grades, and classroom social behavior were significant predictors of academic achievement. Intelligence and standardized achievement test scores contributed little in prediction of teacher grades but they contributed significantly in the prediction of achievement test scores. (Author)

FORM 510

PRINTED IN U.S.A.

ED 076600

TM 002 580

Prediction of Achievement With Measures of Learning, Social Behavior, Sex and Intelligence

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Colleges and universities use academic prediction systems to identify students who should be placed in special sections of courses, receive remedial instruction, or bypass some courses. Prediction of achievement could also be useful at the elementary level, but it is rarely attempted.

Bloom (1964) presented empirical evidence that the best predictors of behavior will be assessments of similar or closely related behavior. Feldhusen, Thurston, and Benning (1971) found that reading and arithmetic scores based on standardized tests and teacher grades were long-range (five years) predictors of academic achievement in those areas. Klausmeier and Ripple (1971) reported evidence from several studies which indicate that academic achievement is best predicted by measures of achievement. Lavin (1965) and Bloom and Peters (1961) concluded that academic achievement measures are strong predictors of subsequent academic performance.

A paper presented at the Annual Meeting of the National Council on Measurement in Education, New Orleans, 1973.

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Academic performance as reflected in teacher grades is probably based on a number of factors such as children's attitudes, interests, personality characteristics and social class determinants in addition to learning or achievement (Lavin, 1965). Thus, if teacher grades are to be predicted, a predictor which incorporates these factors, namely, earlier teacher grades, should be the best predictor.

In a review of the literature on the relationship between intelligence and grades Lavin (1965) concluded that they were correlated at about .60. DeCecco (1968) examined the relationship between intelligence and achievement and concluded that intelligence is one of our best single predictors of achievement. A high correlation between intelligence and academic achievement is now commonly assumed by most educators.

Social behavior is also predictive of subsequent academic achievement. Students who exhibit consistent non-productive social behavior do not learn well in the classroom. Their failure to achieve at one level is predictive of lower achievement at subsequent levels. Feldhusen, Thurston, and Benning (1970) reviewed the literature and found evidence of a relationship between social behavior in school and achievement. In their own research they also found that children who are consistently aggressive and disruptive in the classroom achieve at far lower levels than their peers who exhibit socially approved behavior (Feldhusen, Thurston and Benning, 1971). Klausmeier and Ripple (1971) reported on research comparing the academic achievements

of boys and girls. They found girls to be higher than boys in achievement in mathematics, language and handwriting. They concluded that such differences between boys and girls are significant for educators. When boys and girls of the same age are enrolled in a class together, instruction should be individualized to meet their different needs.

From this review it may be concluded that sex, achievement and social behavior may be predictive of subsequent achievement. Additional measures such as intelligence and standardized achievement test scores may not increase predictability.

This research was concerned with the prediction of academic achievement at the elementary level using measures of achievement, intelligence, sex, and social behavior as predictors. The specific questions investigated were:

1) Are measures of sex, social behavior and teacher grades significant predictors of subsequent academic achievement?

2) Is predictability increased significantly if pupils' scores on the Sequential Tests of Educational Progress (STEP) and intelligence test scores are added to the battery as predictors?

PROCEDURES

Teachers of grade three throughout an entire county nominated the two boys and two girls who were most aggressive-disruptive and the two boys and two girls who were the most prosocial in their classroom behavior. Kuhlman-Anderson Intelligence Test scores; scores on the Sequential Tests of

Educational Progress (STEP) for reading, social studies, science and mathematics, and teacher grades for English, social studies, science and mathematics were secured from school records.

The criterion measures to be predicted were: teacher grades for English, social studies, science, and mathematics and standardized achievement tests in reading, social studies, science and mathematics. The teacher grades were the average for all courses taken in a subject matter area in high school. The standardized achievement scores were derived from performance on the Sequential Tests of Educational Progress, Iowa Test of Educational Development and the Science Research Associates Achievement Series. Different tests were used in different schools. Percentile scores were secured and normalized using an arcsin transformation.

Sex and social behavior were assessed as part of the original nomination process. Scores for intelligence, STEP and teacher grades were secured from school records based on testing and grading four years after the original nomination of the youngsters in third grade. The criterion measures, teachers grades and standardized achievement test scores, resulted from testing and grading eight years after initial identification.

Complete data were secured for 187 children. The sample was randomly subdivided into two subsamples to be used in validation and cross validation analyses. The data was analyzed

in four stages. In stage I teacher grades, social behavior and sex were analyzed as predictors of subsequent teacher grades and standardized achievement test scores; in stage II STEP scores were added as predictors; in stage III intelligence scores were added to the stage I predictors, in stage IV STEP and intelligence scores were added. In each stage a multiple linear regression technique (Dixon, 1967), was used to generate prediction equations for each criterion measure. An F test described by Guilford (1965) was used to test the significance of increments in R between stages. Alpha was set at .05 for all tests of significance.

RESULTS

Stage I

The results of the stage 1 analyses for prediction of teacher grades are presented in Table 1. All of the multiple correlations were significant and ranged from .64 to .78. Moreover, all of the cross-validation correlations, which ranged from .61 to .80, were significant. The maximum shrinkage was .03 for the criterion teacher grades in science in stage I where R was .64 and dropped to .61 in cross validation.

The results for the prediction of standardized achievement test scores are also presented in Table 1. All of the multiple correlations were significant and ranged from .73 to .79. The cross-validation correlations ranged from .69 to .82 and were all significant. The maximum shrinkage was .10 for the science score.

Stage II

In stage II, STEP scores were added to the stage I battery of predictors. (see Table I). It was found that the addition of STEP scores as predictors did not significantly increase the predictability of any of the teacher grades (see Table 2).

The results of analyses for stage II for the criterion of standardized achievement test scores are also presented in Table 1. The F values for comparisons of stage I and II predictions for standardized achievement scores are given in Table 2. Significantly higher multiple R's were obtained for all four criteria.

Stage III

In stage III, intelligence test scores were added to the original predictor battery of stage I. The results of the comparisons of stage I and III multiple R's are presented in Table 2. For the criterion of teacher grades in social studies and mathematics, significant increases were found when intelligence was added to the original predictor set of stage I.

For the criterion of standardized achievement test scores the comparisons of multiple Rs between stages I and III revealed that all four F values were significant. All of the R's increased when intelligence was added as a predictor. The maximum gain was for reading where the multiple R of .73 was increased to .81.

Stage IV

In stage IV, STEP scores and IQ were both added to the stage I predictors. Comparisons between stage IV and the other three stages for the criterion teacher grades are presented in Table 2. The results of each comparison are presented next.

The comparison between stage IV when intelligence and STEP scores were both added as predictors and stage I revealed no significant gains in predictability of teacher grades. It should be noted that even though there were significant gains in R from stage I to II or I to III there might still be no significant gain from stage I to IV because the predictor set is larger and the denominator in the F test increased proportionately more than the R^2 in the numerator. The gain in predictability from stage II to IV was significant only for the criterion of teacher grades in social studies. Finally, when stage IV was compared with stage III, no significant gains were found in predictability of teacher grades.

Comparisons between stage IV and stage I for the criterion of standardized achievement test scores are presented in Table 2. The stage IV gain in predictability over stage I was significant for all the criterion test scores. When stage IV was compared with stage II the gains were significant for the prediction of reading and mathematics. Finally when stage IV and III were compared the gains in predictability were significant for social studies and science.

The simple correlations of all predictors with the criteria are presented in Table 3. All of the correlations of behavior with achievement criteria are significant and negative. All of the cognitive criteria have high inter-correlations. Sex was a high negative correlate (-.55) of STEP science achievement. Boys were higher achievers than girls.

DISCUSSION AND CONCLUSIONS

The Research Questions

The first research question of the present study was:

> Are measures of sex, social behavior and teacher grades significant predictors of subsequent academic achievement?

The multiple correlations for the prediction of teacher grades using stage I predictors were all high and significant ranging from .64 to .78. For the criterion standardized achievement test scores, the degree of predictability was also high ranging from .73 to .79. Most of the cross validations showed only slight shrinkage. These results suggest that teacher grades and an evaluation of social behavior obtained from teachers are highly predictive of achievement four years later.

The second research question was:

> Is predictability increased significantly if STEP and intelligence test scores are added to the battery of predictors?

The gain in predictability of teacher grades was not significant when STEP scores were added to the original predictor set. However, in predicting standardized achievement test scores the addition of STEP scores as predictors increased the multiple correlations significantly and all the cross validations showed only slight shrinkages. This would imply that the prediction systems developed using stage II predictors were quite stable. The results are also logical. One would expect that standardized achievement test scores would improve the prediction of later performance on standardized achievement tests.

The gain in predictability of teacher grades in mathematics and social studies was significant when intelligence test scores were added to the battery. For the four standardized achievement test scores the gains in predictability were all significant when intelligence was added to the battery. The stability of the prediction equations developed in stage III was also high. The slight shrinkages occurring in cross validations would indicate that these prediction equations are quite stable. Thus, it appears that intelligence test scores can make a worthwhile addition in a prediction battery consisting of measures of teacher grades, sex and social behavior.

In stage IV all of the multiple correlations were high and significant. The small shrinkages occurring in cross validation would also imply that these prediction equations are very stable. However, the gain in R over stage I was not significant for any of the criteria of teacher grades. In the prediction of the four standardized achievement tests all of the gains were significant.

Comparisons were also made between stage IV when both intelligence and standardized achievement test scores were in the battery of predictors and stages II and III when only one or the other were added. Significant increments in predictability were found for all four standardized achievement criteria but for only one of the teacher grades criteria, social studies.

In general it seems safe to conclude that standardized achievement test and intelligence test scores chiefly increase predictability of standardized achievement test scores, not teacher grades. These results are consistent with Bloom's review (1964) in suggesting that the best predictors of achievement are prior achievements. Achievement levels are probably quite stable over time and therefore are predictable from achievement measures. Bloom suggests that any measurement of achievement at a point in time is actually a composite of prior achievement levels plus some intervening gain. Thus, the prior measure serves chiefly as an identity element in prediciting a component of a later achievement level.

For a variety of practical reasons prior measures of achievement are the most useful predictors of achievement. They are more likely to be available unobtrusively (Webb et. al, 1966). That is, they are obtained as an ongoing aspect of instructional activities. Intelligence tests do not appear to be directly related to the instructional program. Prior measures of achievement also have greater diagnostic value than

other measures. They reveal areas in which a student is weak and in need of special assistance. Finally, prior measures of achievement as reflected in teacher grades probably reflect other pupil characteristics such as attitudes and motivation.

Sex and social behavior were significant predictors for a number of criteria. They are easily obtained predictors. They may serve a valuable diagnostic function in alerting the teacher to the effects of sex role and social behavior on achievement. Children whose classroom behavior is aggressive and disruptive are especially likely to experience other personal and social adjustment problems and not to achieve well.

Academic predictions should be used to generate prediction equations to identify individual children who will be low achievers and who should therefore receive special remedial instruction. Information concerning the predictor variables and a child's status on each predictor should be useful in diagnosing his difficulties. Academic achievement variables should be especially useful as diagnostic evidence since they should reveal a child's particular weaknesses.

Building prediction systems of the type described in this report should be no great problem in schools which have their own computer systems. For schools which do not yet have a computer, the service should be available at a nearby college or university. While some consultative service might be necessary in developing the prediction system, the subsequent operational stage could be carried on by clerical personnel.

Table 1

Multiple Correlations for Third Grade Students by Stages

PHASES	CRITERIA							
	Teacher Grades				Standardized Achievement Scores			
	English	Social Studies	Science	Math	Reading	Social Studies	Science	Math
Stage I								
Validation R = N = 94	.74	.78	.64	.75	.73	.73	.79	.77
X-Validation r = N = 93	.78	.80	.61	.78	.72	.75	.69	82
Stage II								
Validation R = N = 94	.76	.79	.66	.77	.80	.83	.85	.80
X-Validation r = N = 93	.76	.82	.64	.77	.82	.82	.71	.86
Stage III								
Validation R = N = 94	.75	.80	.65	.77	.81	.77	92	.83
X-Validation r = N = 93	.78	.81	.63	.78	.78	.77	.68	.84
Stage IV								
Validation R = N = 94	.76	.81	.67	.78	.83	.83	.86	.82
X-Validation r = N = 93	.76	.81	.67	.77	.81	.82	.71	.86

All Multiple correlations are significant.

Table 2

F Values for Comparison of Multiple Correlations Between Stages for Third Grade Sample

PHASES	CRITERIA							
	Teacher Grades				Standardized Achievement Scores			
	English	Social Studies	Science	Math	Reading	Social Studies	Science	Math
Stage I vs. Stage II	.75	.85	.92	1.89	6.22*	10.75*	7.98*	3.38*
Stage I vs. StageIII	.03	7.91*	.41	4.56*	29.86*	10.18*	10.52*	14.70*
Stage I vs. Stage IV	.67	1.66	.94	1.90	7.74*	8.52*	6.55*	3.69*
Stage II vs. StageIV	.35	4.73*	1.03	1.86	10.85*	.09	.80	5.08*
Stage III vs. StageIV	.83	.17	.98	1.22	1.90	7.35*	5.05*	.94

* Significant

Table 3

Simple Correlations between Predictors and Criteria for Third Grade Sample*

PREDICTORS	CRITERIA: Teacher Grades				Standardized Achievement Scores			
	English	Social Studies	Science	Math	Reading	Social Studies	Science	Math
1. Sex	.11@	-.07@	-.09@	-.12@	-.18@	-.30	-.55	-.47
2. Behavior	-.40	-.47	-.28	-.39	-.48	-.38	-.21	-.32
3. Intelligence	.52	.68	.48	.63	.77	.64	.56	.66
4. Teacher Grade English	.71	.70	.53	.61	.63	.42	.29	.43
5. Teacher Grade Social Studies	.58	.66	.49	.58	.59	.59	.56	.52
6. Teacher Grade Science	.54	.66	.58	.64	.47	.52	.46	.53
7. Teacher Grade Mathematics	.65	.69	.57	.70	.63	.65	.53	.60
8. STEP Reading	.52	.63	.41	.54	.70	.68	.48	.52
9. STEP Social Studies	.58	.56	.42	.56	.67	.56	.40	.42
10. STEP Science	.45	.53	.42	.61	.74	.79	.67	.69
11. STEP Mathematics	.41	.59	.46	.61	.67	.74	.77	.69

* All correlations are significant except those with an @.

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